

in but fourteen states and territories; the 1st, 12th to 14th, having each almost the same number as the 15th.

In Dakota, Florida, Illinois, Iowa, Minnesota, Nebraska, and Texas thunder-storms occurred on from twenty-five to thirty days during the month; Florida reporting the maximum

number of dates. They occurred on six days, or less, in Connecticut, District of Columbia, Idaho, Kentucky, Maryland, Nevada, New Hampshire, and Washington Territory; Idaho reporting the least. There was no state or territory in which they did not occur:

Table showing the number of stations in the several states and territories reporting thunder-storms for each day during July, 1888.

State or Territory.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	Total
Alabama.....		1	1	1	1	3	2		2	2	1				1		1		2		1		1		2	2		1	2	2	29	
Arizona.....			1			1				2	3		3	3	3	4	6	5	2	2	2	1	4	1	6	3	4	1	7	6	5	85
Arkansas.....		2	2	1	3	3		2	3							3	2	2	1	1	1				6	1	2	7	2	2	32	
California.....		1		1							3					1	3	3		1	1	2	2	3	2	1	3	1	1	1	16	
Colorado.....				1			3	2						1	3	1	2			2	1	2	2	3	2	1	3	1	2	1	37	
Connecticut.....					4							1								2	2	1	1	1	1	2	2	2	3	7	111	
Dakota.....	9	2	5	5	3	2	9	2					9	1	6	1	1			7	3	7	1	3	6	5	3	7	5	7	2	
District of Columbia.....					1			1	1											3	5	5	4	3	4	4	4	3	4	3	1	
Florida.....	3	6	5	1	2	1		2	3	2	3	4	1	2	7	7	2	1	3	3	2	1	1	4	5	4	4	4	3	4	59	
Georgia.....					4	3	1	2	3	3	2	1	1	2	2					2	2	1	1	4	5	4	4	5	4	3	2	
Idaho.....																															2	
Illinois.....		3	26	29	5	4	15	37	12	2			1	10		6	6	2	1		2	14	1		10	20	11	12	4	3	252	
Indiana.....				4			4	3	2								1				1	3						4	1		2	
Indiana Territory.....					1	2		3									2	2	2	1											13	
Iowa.....		2	20	24	5	4	17	14	1				8	7		11	2	1	1	1	16	2	1	4	7	9	4	1	3	1	8	
Kansas.....		1	2	1	2	3	2	13	6				3	6	6	13	2	1		1		4	7	5	2	1	3	2		1	9	
Kentucky.....				1			2	2	2								1														66	
Louisiana.....	4	3	3	2	4	2	3	4	4	2	1			1	2	4	6	2	3						2	1	7	3	1	1	18	
Maine.....					1		2				4	1																			4	
Maryland.....																															41	
Massachusetts.....	1				8						10	2								3		1	8	2	1				5		150	
Michigan.....		2	16	9	3	14	7	14	5	4	3	8									2	16	3			7					24	
Minnesota.....	11	9	5	3	4	7	10	1	2	4	2	1	3		2	6	1		1	6	8	1			5	1	6	8	8	12	3	
Mississippi.....	1		1	1	1	2			2	2	1						2														1	
Missouri.....							1	2	1							3															1	
Montana.....	2		1		1	4	2	1					5	1	2	1				1	1	1			2	2	6	2	2	1	39	
Nebraska.....	1	2	4	3	1		4	6	2				5	2	2	5	2				5	4	5	1	4	1	7			1	69	
Nevada.....																															5	
New Hampshire.....							1													1	2										12	
New Jersey.....	1		1	1	4		3				5	1	1						1	3	2	1				1	4	1		3	30	
New Mexico.....	2	1			1								1	2	1	1			1	2	2	1	5	4	2	1					68	
New York.....				3	12		1	1	1	1	13	1							7	12	2	2		1	1						7	
North Carolina.....	2			3	3		1	3	1	5			2													1	1	4	5	2	1	
Ohio.....				11	5	1	10	11	3		8	3																			1	
Oregon.....																															2	
Pennsylvania.....			1	6	20	1	2	8	3	1	3	12								2	5	2	1	1	7	11					1	
South Carolina.....	1	1			3	1																									2	
Tennessee.....		1	4	8	10	2	8	5	12				2	1	1				2	2	3	3		1	4	7	8	7	10	10	9	
Texas.....	5	3	3	6	4	3	5	3	2	4	1	1	2		1	2	4	4	4		1	2	1	1	2		4	2	1	3	11	
Utah.....																															31	
Vermont.....					1		2		1		5									1	2		3				1	2	3	1	1	41
Virginia.....	1	1	1	2	6	1	1	5	5	1	1	1	3	1		1			1	1	1		1	3		1	2	3	1	1	7	
Washington.....																															2	
West Virginia.....				3	5		5	4	3	1		1	1						1	1	3										31	
Wisconsin.....		1	7	3		11	1	6													6	8				1	3			4	6	9
Wyoming.....	5				3	2	4	4												2		1	3	3	5	2	3	1		2	1	44
Number of States reporting.....	15	18	21	25	34	24	28	30	27	16	24	17	17	15	14	21	25	20	20	29	18	25	23	27	21	23	32	29	23	32	29	

#### AURORAS.

Auroras were observed on but few dates during July, all of which were very faint and confined to small sections of the country.

Auroras were observed during the month as follows: 1st,

Alpena, Mich.; Lyons and Oswego, N. Y. 7th, Gardiner, Me. 16th, Burlington, Vt. 17th, Oswego, N. Y. 22d, Newburyport, Mass. (suspected). 28th, Gardiner, Me.; Lyons, N. Y.; Burlington, Vt. 29th, Webster, Dak.; Gardiner, Me. 13th.

#### MISCELLANEOUS PHENOMENA.

##### DROUGHT.

Lead Hill, Boone Co., Ark.: the month has been very warm and dry, and crops are suffering severely from drought.

Fort Apache, Ariz.: the drought which had continued uninterrupted for sixty days was broken by light rain on the 6th, and frequent rains occurred after that date throughout the month.

Yankton, Dak., 13th: the protracted drought in this vicinity has caused some damage to small grain; the drought was broken by the heavy rains on this date.

Augusta, Ga.: the prevailing dry weather during the first nineteen days of the month caused serious apprehension of a total failure of corn and other crops; the drought was broken by showers on the 20th.

Salina, Saline Co., Kans.: the unusually hot and dry winds during the last ten days of the month have reduced the corn crop about 40 per cent., and creeks and wells are running short of water. A similar period of heated winds has not occurred since 1874.

Cunningham, Kingman Co., Kans.: the hot and dry weather during the last ten days of the month has affected the crops

very seriously in counties south of this place; the drought has been still more severe, and farmers are cutting up thin corn for fodder.

Yates Centre, Woodson Co., Kans.: the month has been unusually dry, corn is much damaged, pastures are drying up, and water for stock is scarce.

Lamar, Mo., 4th: the drought in this section is doing serious damage to corn. Rain fell on the 8th, breaking the drought. It was reported on the 26th that stock and crops were suffering from drought.

Springfield, Mo., 26th: the protracted drought of the past fifteen days has been very injurious to crops.

Thornville, Lapeer Co., Mich.: the month has been very dry; corn, potatoes, and young clover have suffered most from the drought.

Wytheville, Wythe Co., Va., 31st: a drought has continued for the last two months, and though light rains have fallen at intervals, they have not been sufficient to break it, and all kinds of vegetation have suffered in consequence.

##### FOREST AND PRAIRIE FIRES.

Coral, Montcalm Co., Mich., 19th: fires in the woods during

the past few days have done great damage. At Howard City great damage is reported along the railroads.

Watertown, Jefferson Co., N. Y., 18th: the unusually dry weather that has prevailed throughout northern New York, besides ruining the hay crop, has resulted in a large loss to farmers and others by fire. Many valuable pieces of timber, as well as fencing and other property, were destroyed, and the losses will amount to many thousands of dollars.

Prairie and forest fires occurred also as follows: Fort Reno, Ind. T., 4th, 6th, 8th; Fort Bridger, Wyo., 10th, 15th; Fort Sill, Ind. T., 23d to 31st; Ashland, Oregon, 25th.

#### HALOS.

The dates on which solar halos were observed over the greatest extent of territory during July were from the 6th to 11th, 16th, 23d, and 31st; they were least numerous on the 4th, 12th, 19th, 22d, and 27th; none were observed on the 20th. They were observed on from eight to thirteen days in Dak., Ill., La., Mich., N. Y., Ohio, Va.; Ohio reporting the maximum; none were reported from Ala., Colo., Conn., Del., D. C., Md., Miss., Mont., Nebr., N. Mex., R. I., W. Va., Wyo.

But few lunar halos were reported during the first half of the month, there being eleven days during that period on which none were recorded; the greatest number, though not numerous, were reported on the 17th and 22d, in eight states and territories. They were seen on from five to seven days in Ark., Ind., Mo., Tex. None were reported from Ala., Cal., Colo., Conn., Dak., Del., D. C., Idaho, Ind. T., Ky., Me., Md., Miss., Mont., N. Mex., N. Y., Ohio, Oregon, R. I., S. C., Utah, Vt., Wis., Wyo.

The phases of the moon, Washington mean time, during July, as given in "The American Ephemeris and Nautical Almanac," are as follows: new moon, 8th, 13h. 8.4m.; first quarter, 15th, 19h. 4.6m.; full moon, 22d, 12h. 36.9m.; last quarter, 30th, 3h. 21.4m.; apogee, 3d, 5.3h.; perigee, 18th, 24.0h.; apogee, 31st, 0.9h.

#### METEORS.

New York City: a meteor of unusual brilliancy was observed at 10.10 p. m. on the 4th; it crossed the sky from the northwest to the southeast and had the appearance of an ordinary sky rocket.

Fort Stanton, N. Mex.: a very brilliant meteor was observed at 11 p. m., 4th; it was first visible in Azimuth 190° and altitude 30° and traveled about 20° in a southwesterly direction.

Webster, Day Co., Dak.: a large meteor was observed about 10 p. m., 11th; it exploded in the north at an altitude of 45°; the meteor was similar to the sun in brightness and objects cast shadows to the south.

Montrose, Colo.: an unusually bright meteor was observed in the north, altitude 35°, at 11.30 p. m., 22d; it moved in a northerly direction and was visible for about three seconds. The meteor was followed by a long ray of light which remained in sight for about eighteen seconds.

Auburn, Ala.: an unusually large meteor was observed in the north at 9 p. m., 25th; it left a blue streak in its path.

Butlerville, Jennings Co., Ind.: a bright meteor was observed on the evening of the 25th; it passed almost due east of this place and disappeared with a loud report; the meteor was accompanied by a luminous trail which was visible for about ten seconds.

Knoxville, Tenn.: a brilliant meteor was observed falling directly under the polar star at 10.35 p. m., 26th.

Meteors were also observed as follows: 1st, Kalamazoo, Mich.; Stateburg, S. C. 3d, 10th, 19th, 23d, 24th, Kalamazoo, Mich. 4th, Banning Cal.; Marion, Va. 5th, Yaquina Light House, Oregon. 6th, Kalamazoo, Mich.; Wauseon, Ohio; Marion, Va. 8th, Blue Hill Observatory, Mass. 11th, Webster, Dak.; Cedar Rapids, Iowa; Kalamazoo, Mich.; Tiffin, Ohio. 13th, Yuma, Ariz.; Manchester, N. H.; Cleburne and Mesquite, Tex.; Rappahannock, Va. 14th, Newburyport, Mass. 15th, 17th, Utica, N. Y. 18th, Cedar Rapids, Iowa; Kalamazoo, Mich. 22d, Banning, Cal.; Montrose, Colo.; Kalamazoo, Mich.; Beverly and Egg Harbor City, N. J. 24th, Newburyport, Mass. 25th, Jacksonborough, Ohio; Cleburne, Tex. 26th, Webster, Dak.; Kalamazoo, Mich.; Cleburne, Tex.; Rappahannock, Va. 28th, Cedar Rapids, Iowa; Jacksonborough, Ohio; Stateburg, S. C.; Marion, Va. 29th, Kalamazoo, Mich.; Cleburne, Tex. 30th, Cleburne, Tex.; Marion, Va. 31st, Lead Hill, La.

#### MIRAGE.

The only stations reporting mirage during the month were Webster, Dak., on the 2d, 3d, 5th, 6th, 9th, 10th, 12th, 14th to 25th, 31st; and Yuma, Ariz., on the 2d.

#### SAND STORMS.

Red Bluff, Cal.: a dust whirl occurred in this city at 3 p. m. on the 18th, its diameter being about thirty feet; it rose into the air fully 2,000 feet, and when it reached its maximum height the column broke and the dust flew off laterally in all directions. A similar dust whirl, which rose about 10,000 feet in the air, is reported to have been observed at the same time five miles east of this city.

Sand storms occurred also as follows: Rio Grande City, Tex., 9th, 10th, 25th, 29th; Fort McDowell, Ariz., 18th, 19th; Fort Bowie, Ariz., 23d, 26th.

#### VERIFICATIONS.

The percentages of verifications of the official indications of the Signal Service for July, 1888, were not completed in time to be published in this REVIEW. They will be published in a later number.

#### LOCAL VERIFICATIONS.

The following extracts from the published reports of the state weather services for July, 1888, show the percentages of verification of weather and temperature signals for the various states:

*Michigan.*—Weather signals are now displayed in one hundred and thirty towns in the state, and upon the baggage-cars of twenty-six trains of eight of the principal railroads of the state.

The indications are issued at 10 p. m., daily, from the Chief Signal Office, Washington, and are for the twenty-four hours from 7 a. m. to 7 a. m.

The percentage of verification of these indications for July is as follows (the verification is taken from reports of displaymen furnished this office

monthly): temperature, 79.3 per cent; weather, 80.7 per cent.; temperature and weather, 80.0 per cent.

Weather signals are displayed on the baggage cars of the following railroads: C. & G. T. R'y; D., G. H., & M. R'y; D. D. G. T. R'y; M. C., main line and branches; C. & W. M. R'y; G. R. & I. R'y; P. H. & N. W. R'y; and the P. O. & P. A. R'y.

*Minnesota.*—The verification of weather signals were: 72 per cent. for weather, and 79 per cent. for temperature.

*Nebraska.*—The percentages of correct weather predictions for the state were: temperature, 81.6; weather, 78.0; mean, 79.8.

*Ohio.*—The percentage of verification of weather signals received from the Signal Office in Washington, and distributed to twenty-nine display stations, was 81 for weather, and 81 for temperature.

*Oregon.*—At Albany, weather, 78 per cent.; temperature, 84 per cent. At Roseburg, weather, 81 per cent.; temperature, 55 per cent. General average for the state, 75 per cent.

*South Carolina.*—The percentage of verification of the weather and temperature predictions for the state was: weather, 75.0; temperature, 80.0.

#### STATE WEATHER SERVICES.

The following extracts are republished from reports for July, 1888, of the directors of the various state weather services: